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Strategies for empowering the local people to participate in forest restoration

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Abstract Within various parts of the tropics and temperate regions, there are increasingly more efforts towards reforestation or restoration. Interventions in the tropics however, have not adequately addressed the needs of local people compelling them to degrade forests. We conducted a study in and around Mabira Forest Reserve in Uganda with the aim of assessing locally proposed restoration techniques and conditions for empowering local people to raise their willingness to participate in forest restoration practices. We specifically set out to; (i) identify proposed techniques to restore the degraded forests, and (ii) determine the pre-conditions for supporting local people's participation in restoration activities. Data were collected using individual semi-structured interviews, focus group discussions and participatory forest surveys. The findings show that the local people mainly engaged in practices that address their needs concurrently. The most reported practices include: planting trees on farm, enrichment tree planting in the forest, control of soil erosion, and control of invasive alien species. The main pre-conditions for their participation in forest restoration is assurance for more access to forest resources. The efficiency of local people in restoration will be enhanced by strengthening their capacity for collaborative forest management, raising their awareness on restoration, building their capacity, as well as continuous monitoring by forest managers.

Keywords Africa · Incentives · Local people · Livelihoods · Mabira forest · Uganda

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Introduction

Our actions deliberate or not have altered the ecosystem goods and services on which we rely (Hilderbrand et al. 2005). The services that we obtain from properly functioning ecosystems include clean air, fresh water and pollination (Daily 1997). Forest ecosystems offer a myriad of goods and services (Obua et al. 2010; FAO

2012) and provide for over 90 % of the rural livelihood needs in developing countries (Mwavu and Witkowski 2008; Turyahabwe and Banana 2008). Sustaining forest growth and rehabilitating degraded forest landscapes is important to ensure good health and improved livelihoods.

Unfortunately, forest loss and degradation is a worldwide problem, with net annual estimates at 9.4 million hectares by mid 1990s (WRI 1994; FAO 2001, 2005). Although there are reports of increased forest cover in some parts of the world (FAO 2009), in the tropics forest loss is inevitable and the most severe losses are concentrated mainly, although not exclusively, in Africa (Dudley et al. 2005). The local human population explosion is to blame (Vosti 1995; Hilderbrand et al. 2005). Local people especially in the tropics should be supported to adopt appropriate techniques for the use and management of natural forests or develop robust practices to restore degraded forest ecosystems.

In the past 20 years, hundreds of conservation aid interventions worldwide have promoted tree planting schemes, aiming to restore the ecological functions of natural forests with mixed outcomes (Dudley et al. 2005). For example, in China's Loess Plateau, deliberate attempts to restore the landscape through tree planting cannot be overlooked (Chen et al. 2010). In all the efforts however, the need to empower or motivate the local people to participate in forest restoration has not been well appreciated. Yet limiting utilization of forest resources by local people is almost unachievable. Restricting utilization usually perpetuates degradation by escalating the illegal activities (Robinson and Lokina 2011). Stringent policies are required to address the situation. Policy makers however require practical management strategies that are cost-effective and deliverable in a wide range of situations (Cox et al. 2008). Moreover, the local people can be very useful in guiding and supporting conservation efforts initiatives (Abraao et al. 2008), but require encouragement as well as clearly laid out conditions to participate (Marie et al. 2009). After all, restoration efforts must be based on concrete scientific evidence (Hilderbrand et al. 2005).

Several studies on restoration ecology (e.g. Gaedner et al. 2003; Graham and Naeth 2004; Mackenzie and Naeth 2006; Cox et al. 2008; Chen et al. 2010) have focused on soil restoration techniques. Specifically, Moynahan et al. (2002) quantified arbuscular mycorrhizae colonization after liming and re-vegetation in an abandoned metal contaminated mine. Colonization by mycorrhizae can significantly affect plant growth and pattern of succession after disturbance (Haselwandter 1997). On the other hand, Gaedner et al. (2003) found that the application of compost, enhanced soils for restoration purposes. In particular, studies on the social and political environments, that usually determine the success of a developed technique, need special attention (Gobster and Hull 2000). Failure to accommodate these perspectives has always led to short lived success of vegetation restoration projects (Choi et al. 2008).

Arguments for forest restoration have gained currency (Mansourian et al. 2005). This is especially the case in the developing countries where the notion of involving local people in managing protected areas (PAs) is wide spread. Generally, the expectation is that if the local stakeholders contribute to restoring the degraded forests, they would be more concerned about its utilisation thereby ensuring sustainability of conservation efforts. Their involvement in developing appropriate restoration practices and addressing conditions for their participation could raise their confidence with the PA managers. Developing forest restoration practices however requires interventions tailored to the local socio-economic conditions of the local people (Tabuti et al. 2009). Moreover, socio-economic and political aspects of the people living near forests are increasingly becoming important and should not be overlooked in the overall approach to restoration (Temperton 2007), especially in the process of decentralisation of forest management (Rives et al. 2013). Furthermore, considering the sociological elements of restoration is likely to be critical in ensuring community support for future restoration projects (Berry et al. 1996; Choi et al. 2008; Rives et al. 2013).

So far, there is limited success recorded probably because the local people's willingness and ability to participate in conservation practices is usually ignored or taken for granted. Therefore, answers to important management questions such as (i) which practice to promote, (ii) who to involve, (iii) what species to use, (iv) what conditions are favourable (v) where to plant, and (vi) how to assess success (Ruiz-Jaen and Aide 2005), have been delayed. Interventions are urgently needed to obtain empirical data on sustainable practices that can mutually address the local people's needs as well as restore the integrity of the ecosystems on which they ultimately depend.

Around and in Mabira Forest Reserve (MFR) like in other PAs of Uganda, over 90 % of the household needs

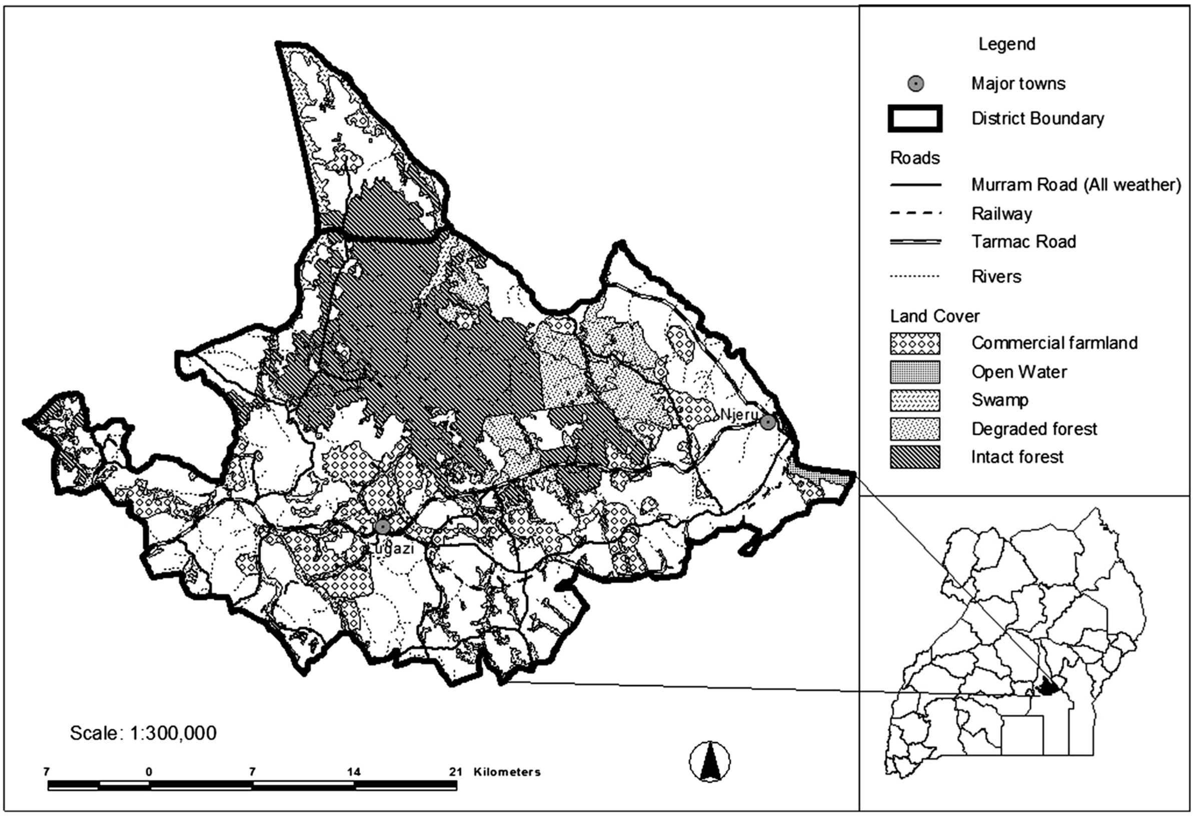

Fig. 1 Map of the study area showing location of degraded and un-encroached forest areas as well as agricultural farms in and around Mabira Forest Reserve in Uganda

and small scale industry energy is from biomass collected from natural forest and allied tree resources (MWLE 2001). The reliance on forest resources usually leads to forest degradation. Besides, there are other threats to local biodiversity conservation efforts including; (i) colonization of the degraded forest sites by invasive alien species, (ii) charcoal burning and agricultural expansion. Active re-vegetation methods are needed to increase the performance of the native plant species and favour the development of an appropriate native plant community that can also serve as natural a barrier to reinvasion (Kettenring and Adams 2011). Involving local people in determining appropriate techniques and practices for forest restoration and identifying conditions for implementation is likely to yield positive results (Alday et al. 2013).

We report techniques that have been locally proposed to restore a degraded forest and examine the conditions for local people's willingness to participate in implementing such techniques in their practices. We hypothesise that the socio-economic attributes of stakeholders' surrounding the forests influence the nature of practices selected and the conditions for local participation, and that gender analysis influences the selection of restoration practices around MFR. There are important differences between men's and women's perspectives on and approaches to using forest resources (Maginnis et al. 2011).

The study area and methods

The study area

Mabira Forest Reserve is located between 0°24′–0°35′N and 32°52′–33°07′E in Central Uganda. It is 54 km from Kampala the capital city and 26 km from Jinja the second largest town (Fig. 1).

The reserve covers up to 306 km^2 and is one of the important PAs in Uganda harbouring many rare and threatened species (Muramira 2001; Baranga 2007). Up to 47 % of Uganda's woody plant species grow here, including five tree species (e.g. *Milicia excelsa* (Welw.) C. C. Berg., *Irvingia gabonensis*, *Lovoa trichilioides* Harms. and *Cordia millenii* Bak.) indicated on the International Union for Conservation of Nature (IUCN) Red list (Baranga 2007). The forest also has 287 species of birds, 23 of small mammals, 218 of butterflies and 97 of moths (Davenport et al. 1996). More species in this forest may become vulnerable or threatened if degraded habitats are not attended to.

The forest reserve is zoned into production, ecotourism/recreation, buffer and strict nature reserve, and is managed by a partnership between the National Forestry Authority (NFA) and the local people under the Collaborative Forest Management (CFM) arrangement. The forest has been constantly influenced by human activities (Muramira 2001; Baranga 2007).

In addition, in 2007, a presidential proposal was issued to convert part of the reserve into a sugarcane plantation, with likely negative impacts of disrupting management operations and threatening the survival of many species. Fortunately, this was not accepted. There has, however, been limited effort to restore the degraded forest sites, which situation seems to have favoured the Ugandan government's argument of converting part of the 'degraded forest' into a sugarcane plantation.

Consequently, the enthusiasm of stakeholders in conserving the forest has been lost in a quagmire of directives within which effective management or restoration is difficult to achieve. This is because protected area managers are demoralised and probably uncertain of the Ugandan government's commitment to biodiversity conservation.

The human population living in the forest enclaves is approximately 825,000 with a density of 200–230 people km^{-2} (Mrema et al. 2001). The local people mainly comprise of the Bantu ethnic groups, including various sub-groups or tribes. In our study a tribe included people or groups of people sharing distinct cultural values including language, beliefs and general way of living. The local tribes include the *Baganda*, *Banyarwanda*, *Basoga*, *Bagisu*, *Bakiga*, *Banyakole*, *Bagwere* and *Batoro*. Other ethnic groups such as the Luo (e.g. the *Samia*, *Ateso*, *Langi*, and *Acholi*) also reside in a few localities.

Extensive plantations of tea and sugarcane established by the Sugar Corporation of Uganda Limited (SCOUL) occur around MFR. Some local people reside exclusively in settlements for labourers on the sugarcane and tea estates of SCOUL in the 27 'village enclaves' (Meredith 2004). In this study, a village enclave includes all human settlements partially (50–70 %) or completely (>70 %) surrounded by the forest reserve. The extent of growing crops other than the sugarcanes and tea, is limited by the scarcity of agricultural land and inability to sustain soil fertility on the small (average <1 ha) farms (Meredith 2004). While the out growers of tea and sugarcane constitute of less than 1 % of the local farmers, they occupy up to 46 % of the agricultural land (Mrema et al. 2001).

Apart from working as labourers on sugarcane and tea estates, the local people also participate in ecotourism, extraction of forest resources, and cultivation of crops such as maize (*Zea mays* L.), beans (*Phaseolus vulgaris* L.), ground nuts (*Arachis hypogea* L.), sweet potatoes (*Ipomea batatas* L.), cassava (*Manihot esculenta* Grantz), bananas (*Musa* spp.), pineapple, and vegetables especially *Cleome* and *Amaranthus* spp. The crops are exclusively grown for subsistence use while sometimes the surplus is sold within the local markets e.g., at Najjembe and Namawojjolo. Three cash crops including vanilla (*Vanilla planifolia* Jacks.), khat (*Catha edulis* Forsk) and coffee are mainly grown but on a small scale (i.e. on average 1 ha for vanilla and coffee, and 0.25 ha for khat). These crops are often sold as the sole source of income; with yields influenced ecologically by the presence of a natural forest. This makes the forest very important to local livelihoods and hence necessitates the involvement of local people in forest restoration.

Methods

In the context of multi-stakeholder involvement and management of the forest by zoning, as well as the local people residing in villages inside the forest (with limited legal access to forest resources), the study adopted a subjective sampling strategy using a combination of qualitative and quantitative research methods.

A preliminary survey was conducted involving six village meetings and 18 individual semi-structured interviews with local people, to familiarize with the study area, build local trust, and develop the data collection tools (Sibelet and Mutel 2013).Data in the

main survey were obtained using 12 focus group discussions of 6–10 people, 250 individual semi-structured interviews, 10 key informant interviews and field structured observations. These techniques are described by Barbbie (2004) and Cheng et al. (2011). The combined methods complemented each other, and provided a means of comparing or verifying data obtained using different methods (Salmen 1995; Sibelet and Mutel 2013).

Lists of households in four sub-counties covering the forest reserve (Nagojje, Najjembe, Wakisi and Ntunda) were obtained from the respective headquarters. Overall, a total of 10 village enclaves was purposively considered for the whole study. Village enclaves adjacent to the production and buffer zones were given priority because during the reconnaissance visits, several degraded sites were encountered in these areas. In addition, several indicators of illegal activities such as abandoned charcoal kilns, pitsaw dust and logs were commonly observed in the forest and private land adjacent to these areas. Some of the households located in villages within 1–2 km radius from the forest reserve were also included.

The selected villages were partially or completely surrounded by the forest reserve and include Nagojje, Kasokoso, Kalagala, Nakawala, Namataba, Namulaba, Walubira Ntonto, Sese–Namusa and Bwola. One representative in every sample household participated in a semi-structured interview. Furthermore, two focus group discussions and one key informant interview was held per village enclave. Caution was taken not to raise tension among the residents because during the study period (between 2006 and 2010), the local people suspected the researchers to be government spies on illegal activities in the forest.

The number of respondents participating in the semi-structured interviews varied based on the population and extent of the selected village, each household treated as an interview unit. A minimum of 12 households and a maximum of 40 households was selected in Kalagala and Nagojje respectively (Table 1). All respondents were residents in the respective enclaves including the NFA employees and local people.

Data were collected on locally favoured restoration techniques, choice of species (including species preference, species with potential for domestication, plant uses) important indigenous species, conditions for local people's involvement, socio-economic and political environment and farming practices in the area.

Table 1 Proportion of households considered during semi structured interviews per village enclave in Mabira Central Forest Reserve, Uganda

Village enclave	Total households	Households selected
Bwola	280	30
Kalagala	154	12
Kasokoso	96	18
Nagojje	270	40
Nakawala	60	10
Namataba	280	30
Namulaba	246	28
Ntonto	480	47
Sese-Namusa	40	08
Walubira	260	27
Total	2,166	250

Data analysis

Data from focus group discussions and key informant interviews as well as structured field observations were analysed qualitatively while data from individual interviews were summarised in SPSS version 10.0. Data summaries were transferred to MS Excel for graphical presentation and MINTAB version 12 for statistical analysis. Individual semi-structured interview data were subjected to analysis of variance by ranks (Kruskal–Wallis H and Wilcoxon Signed Rank Z tests) to establish the relationships between socio-economic characteristics (gender, income levels, education, family size and land size) of the respondents and developed practices (Hoft et al. 1999). The qualitative data were analysed collectively with the participants using social methods such as, pair-wise, wealth and preference ranking during data collection. Analysing data concurrently with field work allows for better thinking about its existence and generates new strategies for subsequent data gathering (Miles and Michael 1999).

Results

Locally proposed techniques for restoring degraded forest

Six major techniques were proposed by the participants in this study. Farmers implemented some of them in their practices. Up to 37 % of the respondents proposed

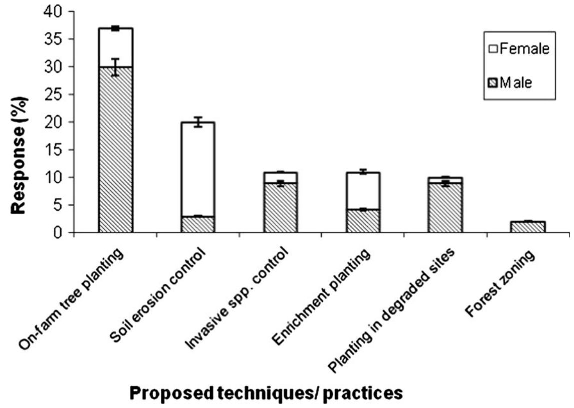

Fig. 2 Proposed techniques/practices for restoring a degraded forest disaggregated by gender in and around Mabira Forest Reserve

tree planting while 20 % reported soil erosion control on farm to be the most important practices for forest restoration (Fig. 2). Planting trees on farm involved deliberate inclusion or retention of selected species on crop fields. The criteria for selecting the tree species were based on local knowledge of use; hence the more uses the higher the chances for being selecting. The other practices include; invasive species control (14 %), forest enrichment planting (14 %), planting in degraded sites out of the forest reserve (13 %) and forest zonation (4 %). On-farm tree planting, invasive species control, planting in degraded forest sites, and forest zonation were mainly suggested by men while the women mostly proposed soil erosion control, enrichment planting, and nursery establishment (Fig. 2). There is however, no significant difference between the practices proposed by male and female respondents ($H = 6.00$, $DF = 6$, $P = 0.423$, Kruskal–Wallis test).

On-farm tree planting

Exotic versus indigenous tree species on-farm Up to 65 % of the respondents (comprising of 40 % males and 25 % females) were interested in planting exotic tree/shrub species on farm, while only 35 % (20 % male and 15 % female) favoured planting such species on farm (Fig. 3).

The species preferred for planting did not significantly differ between female and male respondents ($H = 1.00$, $DF = 1$, $P = 0.317$, Kruskal–Wallis test). The most proposed exotic species were *C. edulis* (50 %) and *Eucalyptus* spp. (25 %), Fig. 4.

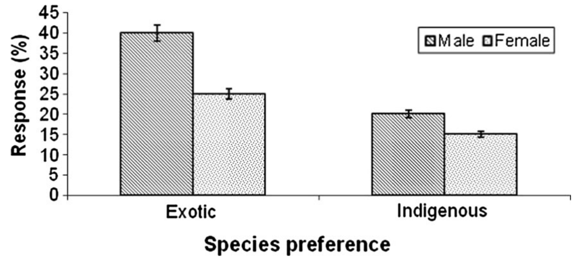

Fig. 3 Species preference for forest restoration in relation to gender of the respondents

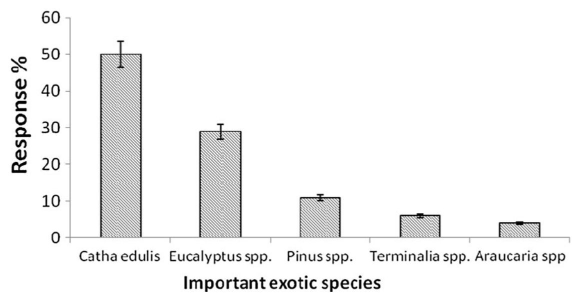

Fig. 4 Exotic species with potential for commercial farming in and around Mabira Forest Reserve

Selection of indigenous species for on-farm planting: The local people selected indigenous plant species for on-farm planting mainly based on local demands. The main species selected belong to the Moraceae and Fabaceae families including: *Ficus natalensis* Hochstetter, *Ficus exasperate* Vahl., *Ficus mucuso* Welw. ex. Ficalho, *Ficus sur* Forssk., *Albizia glaberrima* (Schumach. & Thonn.) Benth., *Albizia grandibracteata* Taub., *Albizia zygia* (DC.) Macbr. and *Maesopsis eminii* Engl. Priority was given to species that occur in MFR. The most highly ranked indigenous tree species used by the local people include *Markhamia lutea* (Bak.) Sprague (20 %), *Entandrophragma utile* (Dawe & Sprague) Sprague. (20 %), *M. eminii* (12 %) and *Zanthoxylum chalybeum* Engl. (10 %), Fig. 5. Some of these are planted on farm but they are not necessarily the dominant species. A list of species used by the local people with potential for domestication (on farm planting) and use in forest restoration is provided in Table 2.

Agroforestry practices Generally, indigenous trees/shrubs as well as exotics such as *Catha edulis, Moringa oleifera* Lam. and *Jatropha curcas* L. are planted on farm mixed with crops such as maize, beans cassava ground nuts, vanilla, coffee and bananas (Table 3; Fig. 4).

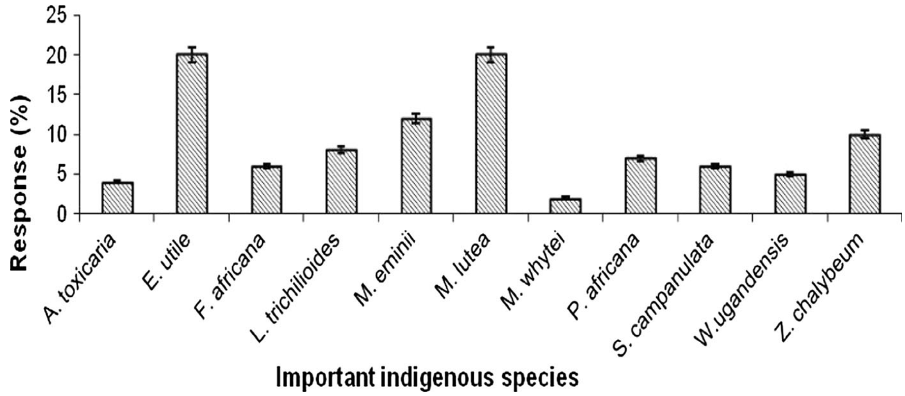

Fig. 5 Important indigenous tree species in and around Mabira Forest Reserve

Trees/shrubs that provide immediate income or grow relatively fast and are locally demanded are planted or retained on farm. Fruit trees such as *Artocarpus heterophyllus* Lam.*, Mangifera indica* L.*, Persea americana* Mill. and *Citrus* spp. are common on farm. Some of the purposes reported include promoting nutrient recycling (30 %), control of soil erosion (27 %), control of moisture loss, providing firewood (16 %), timber (12 %) and supplementing food supplies (5 %), as well as medicine (3 %) Fig. 6. Trees/shrubs with multiple benefits are therefore generally promoted on farm.

Soil erosion control

The following techniques were proposed by the NFA and local people to control of soil erosion:

(i) Barriers using old crop stalks, leaves, stones and grass strips that are built to stop soil erosion especially on steep slopes. In some places buffer strips were maintained instead.
(ii) Crop rotation where a series of dissimilar crops are grown in the same area in sequential seasons.
(iii) Use of crop residues: Leaving the stems, stalks and leaves of the crop in the garden after harvest until the next crop has been established.
(iv) Cultivating while retaining the previous year's crop residue (e.g. maize stalks) on the field before and after planting the next crop to reduce run-off.
(v) Ploughing against rather than up and down the slope in steeply sloping areas.
(vi) Cover crops such as *C. edulis*, *P. vulgaris, Calliandra calothyrsus* Meisn. *Moringa oleifera* Lam. that are commonly integrated with other crops for cash, nutrient cycling, fodder and beverage supply but at the same time cover the soil, also to reduce weeds.
(vii) Mulching where a layer of organic matter (mainly banana leaves) and grasses are used to cover the bare soil between growing plants).
(viii) Planting of perennial crops such as *V. planifolia, C. edulis* and coffee that live for more than 2 years.
(ix) Reforestation: Planting of trees in areas where there has been forest in the past to reconvert such areas back to forest.

Invasive species control

Controlling invasive species in invaded sites was reported to be a major practice that could promote the regeneration of indigenous species. The strategies for the control of Invasive Alien Species proposed by the local people included the following:

(i) Planting indigenous instead of the non-native species.
(ii) Learning to identify invasive species.
(iii) Proper disposal of agricultural and horticultural wastes.
(iv) Targeting the species at the time of flowering or regenerating to deplete its resources. The aim is to control germplasm production, dispersal and germination.
(v) Using manual methods to remove the invasives (for and newly established invasion):

    (a) Cutting (for controlling annual or biennial weeds that spread by seed. The plants are cut when flowering and close to the base of the plant).

Table 2 Plant species with potential for domestication and forest restoration in and around Mabira Forest Reserve

Plant species	Family	Uses
Acalypha neptunica Muell. Arg.	Euphorbiaceae	Meat-roasting
Acalypha ornata Hochst	Euphorbiaceae	Meat-roasting
Aframomum spp.	Zingiberaceae	Wild fruit
Albizia coriaria Welw. Ex Oliv.*	Fabaceae	Firewood, Charcoal, Construction poles
Albizia zygia (DC.) Macbr.*	Fabaceae	Firewood, charcoal, Construction poles
Alchornea cordifolia Muell. Arg.	Euphorbiaceae	Crafts (Stools & chairs)
Alstonia boonei De Wild.*	Apocynaceae	Medicine, Beer-brewing boat
Aningeria altissima (A.Chev.) Aubrev. & Pellegr.*	Sapotaceae	Timber
Antiaris toxicaria (Rumph. ex Pers.) Lesch.**	Moraceae	Timber
Blighia unijugata Bak	Sapindaceae	Timber
Broussonetia papyrifera (L.) Vent[a]	Moraceae	Firewood
Calamus deeratus Mann & Wendl.*	Poaceae	Crafted stool
Celtis africana Burn. f.*	Ulmaceae	Firewood, charcoal, construction poles
Celtis gomphophylla Engl.*	Ulmaceae	Firewood, charcoal, construction poles
Celtis mildbraedii Engl.*	Ulmaceae	Firewood, charcoal, construction poles
Celtis zenkeri Engl.*	Ulmaceae	Firewood, charcoal, construction poles
Chrosophyllum perpulchrum Hutch. & Dalz*	Sapotaceae	Timber
Citropsis artculata (Spreng) Swingle & Kellerman.	Rutaceae	Medicine
Coffea canephora Pierre	Rubiaceae	Frames for stool
Coffeae ugenioides S. Moore	Rubiaceae	Frames for stool
Cordia millenii Bak*	Boraginaceae	Timber, beer-boat
Diospyros abyssinica (Hiern) F. White.	Ebenaceae	Charcoal, walking sticks, construction poles
Entandrophragma utile (Dawe & Sprague) Sprague**	Meliaceae	Timber
Ficus mucuso Welw. ex. Ficalho.*	Moraceae	Beer-brewing boat
Funtumia africana (Benth.) Stapf**	Apocynaceae	Timber
Harungana madagascariensis Pior.*	Gurttiferae	Timber, medicine, dyes for crafts
Holoptelea grandis (Hutch.) Mildbr.*	Ulmaceae	Firewood, charcoal, construction poles
Kigeria africana (Lam) Benth.*	Bignoniaceae	Medicine
Lovoa trichilioides Harms.**	Meliaceae	Timber
Maesopsis eminii Engl.**	Rhamnaceae	Timber
Marantochloa leucantha (K. Schum.) Milne-Redh.	Maranthaceae	Basket weaving material
Marantochloa mannii (Benth.) Milne-Redh.	Maranthaceae	Basket weaving material
Margaritaria discoideus (Baill.)	Euphorbiaceae	Charcoal
Markhamialutea (Bak.) Sprague.**	Bignoniaceae	Construction poles, crafts works
Milicia excelsa (Welw.) C. C. Berg·*	Moraceae	Timber
Mondiawhytei (Hook. f.) Skeels**	Asclepiadaceae	Medicine
Myrianthus holstii Engl.	Moraceae	Wild fruit
Prunus africana (Hook. f.) Kalkman.**	Rosaceae	Timber, charcoal, medicine
Secamone africana (Oliv.) Bullock	Asclepiadaceae	Medicine
Spathodea campanulata P. Beauve.**	Bignoniaceae	Medicine
syzygium guineense (Willd.) DC.**	Myrtaceae	Medicine
Teclea nobilis Del.	Rutaceae	Walking sticks, charcoal, handles for hoes
Trema orientalis (L.) Bl.	Ulmaceae	Firewood
Vernonia amygdalina Del.	Asteraceae	Medicine
Warburgia ugandesis Sprague.**	Canellaceae	Medicine

Table 2 continued

Plant species	Family	Uses
Zanthoxylum chalybeum Engl.**	Rutaceae	Medicine

* Species with potential for domestication; ** locally valuable species for timber and medicine supply; [a] Invasive alien species deliberately grown to supply firewood to local industries

Table 3 Farming practices, common crops, and trees/shrubs on local farms in and around Mabira Forest Reserve

Farming practices	Common crops grown	Common exotic species on farm	Indigenous species
Mixed cropping and agroforestry	Tea, sugar cane, maize, beans, vegetables	*Mangifera indica, Persea americana, Carica papaya, Eucalyptus* spp., *Pinus* sp., *Araur icaria* sp.	*Maesopsis eminii*
Mono-cropping and agroforestry	Sugarcane, coffee, pineapples, vanilla, beans vegetables, cassava and potatoes	*Carica papaya, Artocarpus heterophyllus, Jatropha curcas, Moringa oleifera* and *Persea americana*	*Albizia* spp., *Maesopsis eminii, Ficus natalensis, Dracaena fragrans*
Mono-cropping and agroforestry	Sugar cane, beans, coffee, bananas, cassava, potatoes, vanilla, cabbage, *Amaranthus* sp., *Cleome* sp.	*Carica papaya, Markhamia lutea, Artocarpusheterophyllus, Terminalia* sp., *Jatropha curcas, Senna spectablis, Catha edulis*	*Dracaeana fragrans, Dracaena steudneri, Spathodea campanulata, Milicia excelsa, Pseudospondias microcarpa, Maesopsis eminii*
Agroforestry and mixed cropping	Sweet potatoes, cassava, banana, coffee, vanilla	*Jatropha carcus, Moringa oleifera*	*Albizia* sp., *Maesopsis eminii, Ficus* sp.

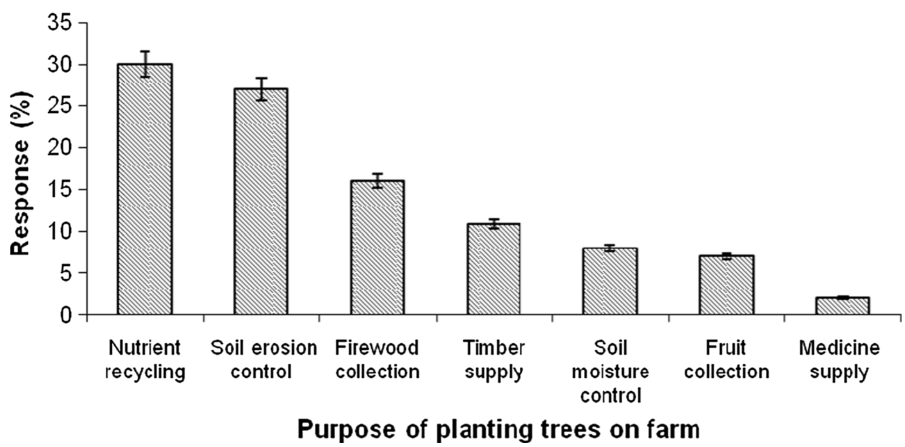

Fig. 6 Purpose of planting/retaining trees on farm in and around Mabira Forest Reserve

(b) Pulling or digging out plants (including their roots) by hand or using a garden fork (used for removing small patches of perennial weeds or saplings). If only the above ground parts are removed, the plants respond by more vigorous regeneration, hence the roots must be removed. The method causes soil disturbance, but should be applied when the soil is moist. If there is regeneration following the soil disturbance, the seedlings should be uprooted as well.

(c) Suffocation or smothering using litter or mulch on small patches of alien invasive species.

(d) Girdling by removing a thin strip of bark all the way around the tree or shrub.

(vi) Chemical methods: the use of herbicides, diesel, tar or salt applied to the stem is proposed in cases where other methods have failed.

Enrichment planting in the forest

Enrichment planting was considered necessary for degraded forest using plant species that are mostly favoured by the local people. Using such species for enrichment planting is required to replenish the wild populations and ensure supply of products from such species. Moreover, local markets are also guaranteed for products from such species. Examples include *Calamus deeratus* Mann & Wendl. planted in degraded sites to meet the demand for craft materials, *A. toxicaria* for timber and *P. africana* for medicine.

Planting in degraded sites

The focus group discussions showed that planting in degraded sites with exotic trees species is carried out as a 'restoration' practice. Some of the local people in partnership with Community Based Organizations are directly involved in identifying degraded sites and planting selected exotic tree species. The purpose is to restore the forest cover in the degraded sites.

Forest zonation

Results of the focus group discussions further showed that zoning the forest was considered important for ensuring effective monitoring of utilisation and protection. Forest zonation was considered to meet the needs of different stakeholders. It is however, necessary to monitor the impacts of utilisation in the different zones. The aspects to monitor have to be clearly spelt out prior to the process in order to get clear cooperation between the different contracting parties (Rives et al. 2013). In relation to monitoring, household survey data showed that 27 % of the respondents are interested in monitoring populations of valuable timber species, while 30 % were interested incraft materials and medicinal plants (Table 4).

Table 4 In forest aspects to monitor per age group and gender by the local people living in and around Mabira Forest Reserve

Forest aspect to monitor	Response (%)				
	Age of respondents (Years)			Gender of respondents	
	(15–35)	(36–50)	>50	Male	Female
Valuable timber species	18	07	02	17	10
Craft material and medicinal plants	08	06	16	8	22
Charcoal production plants	06	12	01	13	4
Wild food sources	02	07	10	13	6
Poles for construction	08	0	0	5	2

Conditions for local participation in forest restoration

Based on the findings from the focus group discussions, the local people identified access rights to forest resources and benefit sharing as the main condition. The local people argue that to ensure their participation in restoring degraded forest, benefits from production zones must be shared with them because they are 'supposed' to be the main users of the forest resource as a means of livelihood.

They further propose the promotion of locally important species as the main strategy for forest restoration. Some of them are willing to participate in restoration if locally useful indigenous species are promoted for planting. They advise that if exotic species are to be introduced, research must be conducted in advance on their ecology (regeneration capacity, effect on native species, potential pests and diseases). Where adoption of new techniques and exotic species is likely to be high, the local people demand sensitization on the likely dangers of the new techniques or species and mitigation measures for such dangers.

Participatory research

The local people propose participation in research on soil erosion control measures so that solutions that are acceptable are designed. Sharing research related information and creating a feedback mechanism between

research institutions and the local people will aid sharing lessons and learning by stakeholders. Restoration of degraded sites will be enhanced once the local people acquire skills to restore and sustain soil fertility.

Raising awareness and monitoring

The local people require regular sensitization on strategies of restoring degraded forest. This would enable stakeholders implement their roles and ascertain the benefits of forest restoration. The relevant skills are required in tree nursery establishment, on farm tree planting, ecological monitoring (to sustain the hope of local people achieving the intended benefits of restoration), and evaluation of proposed techniques/developed practices.

Community to community exchange visits

Community to community exchange visits especially to sites where forest restoration has taken place are desired by the local people to facilitate learning. The visits would encourage individuals to demonstrate new ideas to others by undertaking restoration activities such as establishing woodlots for indigenous tree species. Demonstration of planting indigenous tree species on farm could generate interest across the landscape if choice of the species is based on local needs.

Training as volunteers

The local people reported that they require volunteers to start training in the necessary skills to implement proposed forest restoration techniques. The local people can be trained in raising tree seedlings, planting, and post planting tending operations. They will be empowered to participate in establishment of woodlots and enrichment planting.

Discussion

Proposed techniques and practices for restoring degraded forest

Conservation efforts of PAs should favour practices that contribute to people's livelihoods in order to secure goodwill of the local people (Eilu et al. 2007). In order to be scaled up, vegetation restoration techniques must address a variety of local needs and be acceptable from a socio-cultural context of the beneficiaries (Nederlof and Dangbegnon 2007). Although the concern of women may often not be the same as those for men in a community (Omuregbee 1998; Tiayon 2011; Maginnis et al. 2011), in our study it was not the case. Our study showed no significant difference between the techniques and practices developed by male as well as female participants. This suggests that gender differences may not be important during forest restoration efforts.

The men mostly proposed on-farm tree planting most likely due to a possibility of obtaining timber. The women on the other hand mostly proposed soil erosion control techniques probably because they are mainly involved in agricultural practices (Gladwin et al. 2013). Moreover, providing on-farm labour to ensure the wellbeing of a household is among the gender roles of women in areas around PAs (Nabanoga 2005). Restoration efforts in PAs should promote techniques that contribute to local people's livelihoods as a gesture for cultivating goodwill among stakeholders. In areas where the local people are involved in management of PAs, the selected practices must be acceptable from a socio-cultural context of the beneficiaries (Nederlof and Dangbegnon 2007) in order to be promoted.

Timber is considered to be the most economically rewarding forest resource in the developing world (Kajembe et al. 2005; Tiayon 2011). Usually more men than women are involved in timber related practices probably because it is their gendered role to supplement household income sources (Manuh 1998; Nabanoga 2005). In the present study similar trends were observed but with no conclusive evidence to this effect. Generally, we expect that rural men and women would support each other during income generation in order to ensure progress of their families. However, their level of involvement in income generation would be inclined to their extra activities or the roles they are expected to perform both at household and community levels (Munang et al. 2011). Considering the time, energy, and the working conditions inside the forest, the men are probably more suitable than women after all; most of the women's time is consumed on farms, making them responsible for over 80 % of agricultural work in the

Sub-Saharan Africa (Reyes 2011). Soil restoration as well as tree planting therefore, serves a double purpose for women and men, during forest restoration efforts.

As reported in studies (e.g. Brockerhoff and Kay 1998; Smith and Scherr 2002; Wise et al. 2011) elsewhere, also local people in this study preferred planting exotic to indigenous tree/shrub species. Specifically, this finding is consistent with results of related investigations in some parts of Africa. For example, in a study to prioritize fruit tree species in agroforestry landscapes of Madagascar, Styger et al. (1999) observed that exotic fruit tree species were more planted compared to their indigenous counterparts. This suggests that exotic instead of indigenous species could as well be misguidedly used for "*just*" re-vegetation of degraded forest areas without keeping in mind the original species composition (Ruiz-Jaen and Aide 2005).

Nonetheless, vegetation restoration research in China indicated that indigenous species were instead preferred because exotic species could result into soil dehydration (Wang et al. 2002). The argument for using indigenous instead of exotic species is further supported in other investigations. For example, Eilu et al. (2007) reported that local people in eastern Uganda favoured indigenous species on their farm because of their multiple uses, while Tabuti et al. (2003) observed that some of the indigenous species are used because of their cultural importance.

It seems therefore, that the local people's preferences of species to use for restoration are likely to be influenced by the prevailing local circumstances. The choices of species to plant for example during enrichment planting in the forest or woodlots are likely to be made bearing in mind the returns on every species. In the case of Mabira forest, the local people probably expect to benefit beyond their "basic household needs" from the selected species. Hence, preference for exotic to indigenous species during restoration planting is no surprise, because exotic species including *Eucalyptus* spp., *Pinus* spp., *C. edulis* are easily marketable, available, quickly establishes in the field, have a relatively short rotation period and the degraded forest environment provides an ideal growing environment to satisfy the timber market needs.

Their indigenous counterparts' are lacking of planting materials. Despite efforts by the Ugandan government to increase tree cover, there is limited progress with indigenous species. Possibly lack of viable seed sources and appropriate breeding techniques are to blame. Moreover using native plants from anywhere during restoration process is not encouraged (Davis and Meurk 2001). At the moment, collecting seeds or wildings from the forest seem to be the main strategy for local tree farmers willing to use indigenous species during restoration planting. Unfortunately planting seeds directly from the forest leads to low germination and survival rates and yet obtaining wildings from the forest is laborious, time consuming and affects plant population dynamics. Nursery grown plants stand better quality survival chances in the field than the wildings (Davis and Meurk 2001). Now needs and means are always conditions for innovation (Sibelet 1995), therefore forest restoration practices that are less time consuming and with better success have to be encouraged. Intensifying the planting of indigenous species on-farm could permit substantial regeneration in the affected sites by reducing pressure on wild plant population.

It is important to note that agroforestry systems involve interaction of food crops with exotic as well as indigenous tree/shrub species (Nair 1989). Although it is not enough to develop practices that work in a technical sense (Nederlof and Dangbegnon 2007), a combination of different types of trees is a common practice in agroforestry systems all over the world (Madelaine et al. 2008). Studies (e.g. Styger et al. 1999; Torquebiau et al. 2002; Garen et al. 2010) showed that a number of exotic species play important roles in the livelihood of rural people. A more careful scrutiny indicates that the exotic specie*s* are mainly planted for firewood, food production and medicine supply. None of them however, appear to be targeted towards soil improvement which would be crucial for vegetation restoration (Reubens et al. 2007) e.g. through nitrogen fixation. The recovery of biological interactions is critical for the long-term functioning of a restored ecosystem (Ruiz-Jaen and Aide 2005).

The local people are aware of the decline in soil fertility (e.g. through declining agricultural yields), but they do not appear to realise that some trees fix nitrogen and could improve soil fertility which is crucial for forest restoration (Gaedner et al. 2003; Mackenzie and Naeth 2006). Their choices appear to be influenced mostly by the products they could obtain from particular species (Nair 1989; Tabuti et al. 2009) and sometimes the ecological relationship with crops.

It is therefore necessary to consider tree/shrub species that for example, augment the nitrogen fixing, which would help to improve soil fertility. Ecological processes such as nutrient cycling and biological interactions are important because they provide information on the resilience of the restored ecosystem (Ruiz-Jaen and Aide 2005). Mixtures comprising of mainly indigenous species and food crops should be emphasised as a step towards soil restoration. It is however, necessary to find a threshold or balance between on-farm tree planting and forest enrichment planting as well as using indigenous or exotic species (with each single species) to ensure a sustained products supply for the local market.

Studies in West and Sub-Saharan Africa (e.g., Nederlof and Dangbegnon 2007; Buyinza et al. 2008; Fagbemissi 2010; Larson et al. 2012) observed that the farmers' choices of solutions for farming problem would be based on the level of efficacy they expect from the solution. Furthermore, the choice of the solution is driven by the perceived risks surrounding it (Leeuwis 2004). According to Kettenring and Adams (2011), promoting appropriate native plant communities can be useful against invasive plants progression. In our study, applying chemicals to control invasive species would only be promoted after failing to succeed with the other methods. After all, the chemicals are considered to be expensive and to have health as well as environmental risks. So the method should only be applied after conducting thorough Environmental Impact Assessment (EIA). Efforts to minimise environmental pollution should be prioritized in the process.

Selecting plants for restoration requires knowledge about the local benefits from the different species. Planting exotic species (e.g. *Araucaria* spp. and *Terminalia superba*) to 'restore' degraded forest is perhaps not a good ecological practice for a natural forest as it could interfere with the regeneration of indigenous species (Okullo2004). Some exotic species (e.g. *Broussonetia papyrifera* (L.) Vent, *Senna spectablis* (DC.) H.S. Irwin & Barne by and *Lantana camara*) have turned out to be invasive. These plants dominate various landscapes in and around MFR.

Conditions for local participation in forest restoration

Forest restoration in farming systems with unstable economies depends on a complex of socio-economic attributes including gender (Berry et al. 1996; Temperton 2007). Moreover, identification of reliable markets could increase the benefits from the forest resources. In the current study, availability of new markets for forest resources and local produce will possibly motivate local people to participate in forest restoration. The efficiency of their efforts and efforts of other stakeholders could be enhanced through: (i) participatory research; (ii) raising awareness and monitoring; (iii) community to community exchange visits; and (iv) training as volunteers.

In cases involving the local people, those to take part in monitoring must be carefully selected to enlist trust of the local people. This would make the local people accountable for forest degradation and restoration. The system of control would be implemented through the CFM committees within the framework of the CFM agreements with the NFA. The CFM agreements were signed in 2007, but the process has been evolving since 1997 when the idea was introduced and it is still necessary to monitor and ascertain the effectiveness.

Conclusion

The local people are in general aware of forest degradation, but may not be certain of the full impact of such a situation. The general model for promoting their participation in restoration requires that: they are involved in the development of appropriate practices; and are empowered to participate as 'enlightened' stakeholders.

In general, there is a hierarchy of 'un-negotiable' conditions (access rights to forest resources and benefit sharing), favourable proposals (promotion of locally important species and identification of new markets for forest resources), and strategies for enhancement of efficiency (participatory research; raising awareness and monitoring; community to community exchange visits; and training as volunteers).

To promote the participation of local people in forest restoration, after demonstrating willingness, it is necessary to conduct research on the ecology (regeneration capacity, effect on native plant communities, potential pests and diseases) of exotic species prior to introduction. In addition, wherepromotionof locally important species is likely to be high, sensitization on the likely dangers of the new techniques or species and

skills of implementing mitigation measures for the perceived dangers will encourage local people's participation.

Our study demonstrates the need for additional research to ascertain how restrictions on access perpetuate degradation of forests and allied tree based resources. It is also necessary to determine the threshold or balance between on-farm tree planting and forest enrichment planting (with each single species) to ensure the ecological values, as well as sustainable supply of forest products for local consumption and for the market.

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References

Abraao MB, Nelson BW, Baniwa JC, Yu DW, Shepard Jr GH (2008) Ethno-botanical ground-truthing:indigenous knowledge, floristic inventories and satellite imagery in the upper Rio Negro, Brazil Blackwell Publishing Ltd. www.blackwellpublishing.com/jbi, doi:10.1111/j.1365-2699.2008.01975.x

Alday JG, Cox ES, Pakeman RJ, Harris MPK, LeDuc MG, Marrs RH (2013) Effectiveness of Culluna-heathland restoration methods after invasive plant control. Ecol Eng 54:218–226

Baranga D (2007) Observations on resource use in Mabira forest reserve, Uganda. Afr J Eol 45:2–6

Barbbie E (2004) The practice of social research, 10th edn. Thomson Learning Inc, Belmont. ISBN 0-534-62028-0

Berry MW, Flamm RO, Hazen BC, MacIntyre RL (1996) The Land-use Change Analysis System (LUCAS) for evaluating landscape management decisions. IEEE Comput Sci Eng 3(1):24-35

Brockerhoff EG, Kay M (1998) Prospects and risks of biological control of wilding *Pinuscontorta* in Newzealand. For Envt, 216–223. http://www.nzpps.org/terms_of_use.html

Buyinza M, Banana AY, Nabanoga N, Ntakimanye A (2008) Socio-economic determinants of farmers' of rotational woodlot technology in Kigorobya sub-county, Hoima district, Uganda. S Afr J Agric Ext 37:1–16

Chen L, Wang J, Wei W, Fu B, Wu D (2010) Effects of landscape restoration on soil water storage and water use in the Loess Plateau Region, China. For Ecol Manag 259: 1291–1298

Cheng AS, Danks C, Allred SR (2011) The role of social and policy learning in changing forest governance: an examination of community-based forestry initiatives in the United States. For Policy Econ 13:89–96

Choi YD, Temperton VM, Allen EB, Grootjans AP, Halassy M, Hobbs JR, Naeth MA, Torok K (2008) Ecological restoration for future sustainability in a changing environment. Ecoscience 15(1):53–64

Cox ES, Marrs RH, Pakeman RJ, Le Duc MG (2008) Factors affecting the restoration of heathland and acid grassland on Pteridium aquilinum-infested land across the United Kingdom: a multisite study. Restor Ecol 16(4):553–562

Daily GC (1997) Nature's services: societal dependence on natural ecosystems. Island Press, Washington, p 392

Davenport TRB, Howard PC, Baltzer M (1996) Biodiversity report for Mabira, vol 1–33. Forest Department, Kampala

Davis M, Meurk C (2001) Protecting and restoring our natural heritage—a practical guide—nursery plant grades and their characteristics. Department of Conservation, New-zealand Government. http://www.doc.govt.nz/publications/conservation

Dudley N, Mansourian S, Vallauri D (2005) Forest landscape restoration in context. In: Mansourian S, Vallauri D, Dudley N (eds) Forest restoration in landscapes: beyond planting trees. Springer, New York (in cooperation with WWF International)

Eilu G, Oriekot J, Tushabe H (2007) Conservation of indigenous plants outside protected areas in Tororo District, eastern Uganda. Afr J Ecol 45(3):73–78

Fagbemissi RC (2010) Children and adult strategies to mobilize knowledge and resources to solve the cow pea pest problem in an AIDS context in Couffo, Benin. In: Experts from necessity; Agricultural knowledge of children orphaned by AIDS in the Couffo region, Benin. PhD Thesis, Wagengen University, Wagengen, p 242

FAO (2001) Global forest resource assessment 2000: main report. FAO Forestry Paper 140, Food and Agriculture Organisation of the United Nations, Rome

FAO 2005. Global forest resources assessment 2005: progress towards sustainable forest management. FAO Forestry Paper 147, FAO, Rome. www.fao.org/forestry/site/32246/en

FAO (2009) State of the World forests. Food and Agriculture Organization of the United Nations, Rome

FAO (2012) State of the World's Forests: the first ten issues: in state of the World's forests, Food and Agriculture Organization of the United Nations Rome. ISBN 978-92-5-107292-9. http://www.fao.org/docrep/016/i3010e/i3010e01.pdf

Gaedner WA, Broersma K, Naeth MA, Jobson AM (2003) Influence of biosolids and fertilizer amendments on selected soil physical, chemical and microbial parameters in tailing re-vegetation. In: Proceedings of the Annual BC Mine reclamation, British Columbia Technical and Research Committee on Reclamation, Kamloops, British Columbia

Garen EJ, Saltonstall K, Ashton MS, Slusser JL, Mathias S, Hall JS (2010) The tree planting and protecting culture of cattle ranchers and small-scale agriculturalists in rural Panama: opportunities for reforestation and land restoration. For Ecol Manag. doi:10.1016/j.foreco.2010.10.011

Gladwin CH, Peterson JS, Uttaro R (2013) Agroforestry innovations in Africa: can they improve soil fertility on women

farmers' fields? African Studies Quarterly 6, no. 1 & 2: (online29-12-2013-05-45GMT). http://web.africa.ufl.edu/asq/v6/v6i1a10.htm
Gobster PH, Hull RB (eds) (2000) Restoring nature: perspectives from the socila sciences and humanities. Island Press, Washington, DC
Graham S, Naeth MA (2004) Simulated insitu bioremediation of hydrocarbon contaminated soils. In: Proceedings of the Alberta Soil Science Workshop, Lethbridge, Alberta
Haselwandter K (1997) Soil micro-organisms, mycorrhiza, and restoration ecology. In: Urbanska KM, Webb NR, Edwards PJ (eds) Restoration ecology and sustainable development. Cambridge University Press, Cambridge
Hilderbrand RH, Watts AC, Randle AM (2005) The myths of restoration ecology. Ecol Soc 10(1):19. http://www.ecologyandsociety.org/vol10/iss1/art19/
Hoft M, Barik SK, Lykke AM (1999) Quantitative ethnobotany: applications of multivariate and statistical analyses in ethnobotany. People and plants working paper 6, UNESCO, Paris
Kajembe GC, Nduwamungu J, Luoga EJ (2005) The impact of community-based forest management and joint forest management on the forest resource base and local people's livelihoods: case studies from Tanzania. Commons southern-Africa occasional paper series No. 8. CAAS/PLAAS
Kettenring KM, Adams CR (2011) Lessons learned from invasive plant control experiments: a systematic review and meta-analysis. J Appl Ecol 48:970–979
Larson DF, Otsuka K, Matsumoto T, Kilic T (2012) Should African rural development strategies depend on smallholder farms? An exploration of the inverse productivity hypothesis. The World Bank, Policy Research Working Paper 6190. On line 28-01-2014-15.03 GMT http://www-wds.worldbank.org/servlet/WDSContentServer/wps6190.pdf
Leeuwis C (2004) Communication of rural innovations; rethinking agricultural extension. Blackwell Publishers, Oxford
Mackenzie DD, Naeth MA (2006) Asisted natural recovery using a forest soil propagule bank in the Athabasca oil sands. Proceeding of the 8th international workshop on seeds, CABI Publishing, Wallingford
Madelaine C, Malézieux E, Sibelet N, Manlay R (2008) Semi-wild palm groves reveal agricultural change in the forest region of Guinea. Agrofor Syst 73(3):189–204
Maginnis S, Aguilar L, Quesada-Aguilar A (2011) Forests and gender In: Aguilar L, Shaw DMP, Quesada-Aguilar A (eds), IUCN, Gland, ISBN: 978-2-8317-1428-8
Mansourian S, Vallauri D, Dudley N (eds) (2005) Forest restoration in landscapes: beyond planting trees. Springer, New York in cooperation with WWF International
Manuh T (1998) Women in Africa's development: overcoming obstacles, pushing for progress. Africa Recovery Briefing Paper No. 11, United Nations, New York
Marie C, Sibelet N, Dulcire M, Rafalimaro M, Danthu P, Carrière SM (2009) Taking into account local practices and indigenous knowledge in an emergency conservation context in Madagascar. Biodivers Conserv 18:2759–2777
Meredith WD (2004) Three communities, two corporations, one forest: forest resource use and conflict, Mabira Forest, Uganda. Agroforestry in Landscape Mosaics Working Paper Series, World Agroforestry Centre, Yale University, Tropical Resources Institute, and The University of Georgia, Georgia
Miles MB, Michael A (1999) Qualitative data analysis, 2nd edn. Sage Publications, London
Moynahan OS, Zabinski CA, Gannon JE (2002) Microbial community structure and carbon-utilization diversity in a mine tailings revegetation study. Restor Ecol 10:77–87
Mrema M, Wafula D, Agaba H (2001) Livelihood strategies and the use of forest and tree products in the Mabira forest buffer zone. Agroforestry Programme FORRI/ICRAF Collaborative Project, Kabale
Munang R, Jallow B, Nkem J (2011) Women and woodlots in Tanzania. In: Aguilar L, Daniel MP, Quesada-Aguilar A (eds) Forests and gender. IUCN, Gland. ISBN 978-2-8317-1428-8
Muramira T (2001) Valuing the losses caused to Mabira Forest by hydropower development in Uganda. Innovation 8(2):28–30
Mwavu EN, Witkowski ETF (2008) Land-use and cover changes (1988–2002) around Budongo forest reserve, NW Uganda: implications for forest and woodland sustainability. Land Degrad Dev 19(6):606–622
MWLE (Ministry of Water Lands and Environment) (2001) The Uganda Forestry Policy, Republic of Uganda, p 29, Kampala
Nabanoga GN (2005) Transgressing boundaries: gendered spaces, species, and indigenous forest management in Uganda. Tropical Resource Management Papers 60, ISSN 0926-9495, Wageningen University, Wageningen
Nair PKR (ed) (1989) Agroforestry systems in the tropics. Kluwer Academic Publishers, Dordrecht. ISBN 90-247-3790-7
Nederlof ES, Dangbegnon C (2007) Lessons for farmer-oriented research: experiences from a West African soil fertility management project. Agric Hum Values 24:369–387
Obua J, Agea JG, Ogwal JJ (2010) Status of forests in Uganda. Afr J Ecol. doi:10.1111/j.1365-2028.2010.01217.x
Okullo P (2004) The population structure and utilization of *Zanthoxylumchalybeum* and *Sarcocephalaslatifolius* along the shores of Victoria Nile in Apac district, Northern Uganda. MSc Thesis, Makerere University, Kampala
Omuregbee FE (1998) Communication of improved farm practices to rural women farmers in Benue state, Nigeria. Outlook Agric 27:53–56
Reubens B, Poesen J, Danjon F, Geudens G, Muys B (2007) The role of fine and coarse roots in shallow slope stability and soil erosion control with a focus on root system architecture: a review. Trees 21:385–402
Reyes T (2011) Gender sensitive agroforestry and agribusiness in Tanzania. In: Aguilar L, Shaw DMP, Quesada-Aguilar A (eds) Forests and gender. IUCN, Gland. ISBN 978-2-8317-1428-8
Rives F, Carrière SM, Montagne P, Aubert S, Sibelet N (2013) Forest management devolution: gap between technicians' design and villagers' practices in Madagascar. Environ Manag 52(4):877–893
Robinson EJZ, Lokina RB (2011) A spatial-temporal analysis of the impact of access restrictions on forest landscapes and household welfare in Tanzania. For Policy Econ 13(1):79–85. doi:10.1016/j.forpol.2010.08.003 ISSN 1389-9341

Ruiz-Jaen MC, Aide TM (2005) Restoration success: how is it being measured? Restor Ecol 13(3):569–577

Salmen L (1995) Beneficiary assessment, a qualitative method of information gathering. In: Participation and social assessment tools and techniques, World Bank, Environment Department, paper No. 23, Washington, DC

Sibelet N (1995) L'innovation en milieu paysanou la capacité des acteurslocaux à innover en présenced'intervenantsextérieurs. Nouvellespratiques de fertilisation et mise en bocagedans le Niumakélé (AnjouanComores). INA-PG, Grignon, p 400

Sibelet N, Mutel M (2013) From hypotheses to variables to investigate. In: Sibelet N, Mutel M, Arragon P, Luye M (eds) Qualitative survey methods applied to natural resource management. Online learning modules. http://enquetes-cirad.iamm.fr/course/view.php?id=3

Smith J, Scherr SJ (2002) Forest carbon and local livelihoods: assessment of opportunities and policy recommendations. CIFOR Occasional Paper No. 37, ISSN 0854-9818

Styger E, Rakotoarimanana JE, Rabevohitra MR, Fernandes ECM (1999) Indigenous fruit trees of Madagascar: potential components of agroforestry systems to improve human nutrition and restore biological diversity. Agrofor Syst 46:289–310

Tabuti JRS, Dhillion SS, Lye KA (2003) Firewood use in Bulamogi County, Uganda. Species selection, harvesting and consumption patterns. Biomass Bioenerg 25:581–596

Tabuti JRS, Ticktin T, Arinaitwe MZ, Muwanika VB (2009) Community attitudes and preferences towards woody species: implications for conservation in Nawaikoke, Uganda. Oryx 43(3):393–402

Temperton VM (2007) The recent double paradigm shift in restoration ecology. Restor Ecol 15(2):344–347

Tiayon FF (2011) Gender in tropical forestry: realities, challenges and prospects. In: Aguilar L, Shaw DMP, Quesada-Aguilar A (eds) Forests and gender. IUCN, Gland. ISBN 978-2-8317-1428-8

Torquebiau E, Mary F, Sibelet N (2002) Les associations agroforestieres et leurs multiples enjeux—the multiple challenges of agroforestry associations. Bois et forêts des tropiques 271:23–35

Turyahabwe N, Banana AY (2008) An overview of history and development of forest policy and legislation in Uganda. Int For Rev 10(4):641–656

Vosti S (1995) The role of agriculture in saving the rain forest, a 2020 vision for food, agriculture and the environment. International food policy research institute, Rome

Wang GL, Liu GB, Chang X, Xu MX (2002) A study on the effect of soil water on vegetation rehabilitation in watershed of loess hilly area. J Nat Res 17:339–344

Wise RM, Dye PJ, Gush MB (2011) A comparison of the biophysical and economic water-use efficiencies of indigenous and introduced forests in South Africa. For Ecol Manag 262:906–915

WRI (World Resources Institute) (1994) World Resources 1994–1995: a guide to the global environment. Oxford University Press, New York